Vol. 83, No. 15, pp. 171–182 27 May 1970

PROCEEDINGS
OF THE
BIOLOGICAL SOCIETY OF WASHINGTON

NEW ENTOCYTHERID OSTRACODS OF THE GENUS *ORNITHOCYTHERE* AND THE DESCRIPTION OF A NEW GENUS

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Three new species of entocytherid ostracods, belonging to the genus *Ornithocythere* Hobbs, 1967:2, are described from Kentucky and Mississippi. *Ornithocythere aetodes* (see below) and *O. popi* (see below) were collected from the burrowing crayfish *Cambarus diogenes* in Mississippi. The third species, *O. rhea* (see below), was obtained from the same host species in Kentucky. With the descriptions of these additional forms, the genus now consists of five members, the combined ranges of which appear to be discontinuous, one species occurring in the coastal plain of Maryland and Virginia and the others in Kentucky, Alabama and Mississippi.

Not only have females of all the described members of the genus *Ornithocythere* been correlated with the males but also peculiarities of the genital areas permit the recognition of each, and consequently keys are provided for both sexes. Because the key to the females is based on genital structures, a description of its basic plan and a limited terminology are needed. The genital structures, collectively called the *genital complex*, are situated posterodorsally in the shell of the females. All species of the genus *Ornithocythere* possess a heavily sclerotized *genital papilla*, which appears as a simple cone or cylinder. In addition to the papilla, *O. aetodes* possesses two *alate processes* (wings) which extend ventrally from the level of the papilla. *O. waltonae* Hobbs, 1967:2 and *O. popi* possess a genital complex composed of a papilla and

a *campanula.* The latter is somewhat bell-like, with the papilla, analogous to a clapper, hanging pendant within it. Surrounding the genital structures, regardless of its form, is an amorphous mass on which detritus accumulates.

The genus *Hartocythere* (see below) is erected to receive a disjunct species from Alabama, Florida, and Georgia, which was formerly assigned to the genus *Geocythere* Hart, 1962: 134. When additional species were discovered, it became an orphan in the genus, thus necessitating the proposal of the new genus *Hartocythere.*

I wish to thank Dr. J. F. Fitzpatrick, Jr. and Dr. Horton H. Hobbs, Jr. for their assistance in the preparation of this manuscript and Dr. David G. Frey for his criticisms of it.

Supported in part by NSF Grant GB-4719 to J. F. Fitzpatrick, Jr. and NSF Grant GB-7585 to Gulf Coast Research Laboratory.

Genus *Ornithocythere* Hobbs, 1967

Diagnosis: Terminal tooth of mandible pectinate. Male copulatory complex lacking finger guard and accessory groove; peniferum extending ventrally beyond clasping apparatus; acute, sclerotized, beaklike prominence (resembling inverted head of a bird) directed anterodorsally, its ventral base arising from ventral border of peniferum rather than from anterior surface. Corneous penis large, directed anterodorsally with prostatic and spermatic elements propinquant throughout length; clasping apparatus well-developed, may or may not be divisible into horizontal and vertical rami; vertical ramus with margins entire; horizontal ramus with or without entire borders, ramus terminating in three to five apical denticles. Triunguis females without J-shaped rod or amiculum, but possessing sclerified genital papilla; campanula present or absent; no pectinate process on distal podomere of second antenna.

Type species: Ornithocythere waltonae Hobbs, 1967:2.

Key to Males

1	External border of clasping apparatus entire	*waltonae* Hobbs, 1967:2
1′	External border of clasping apparatus annulate or with rounded prominences	2
2(1′)	Clasping apparatus L-shaped and divisible into horizontal and vertical rami	*rhea* new species
2′	Clasping apparatus with sinuous or simple curve, not divisible into horizontal and vertical rami	3

3(2′) Clasping apparatus S-shaped, with three rounded prominences on external border, terminating in four apical denticles ..... *aetodes* new species

3′ Clasping apparatus with simple curve, mesiodistal surface bearing linear series of four small tubercles, terminating in three to five apical denticles 4

4(3′) Beaklike projection on anteroventral portion of peniferum subacute; two tubercles situated on proximoventral angle of beaklike prominence, third one on ventral margin near apex; clasping apparatus with four mesial prominences proximal to five apical denticles ..... *gypodes* Hobbs III, 1969:169

4′ Beaklike projection on anteroventral portion of peniferum acute, without tubercles; clasping apparatus possessing four annulations proximal to apical denticles ..... *popi* new species

KEY TO TRIUNGUIS FEMALES

1 Genital complex consisting of dorsally situated papilla enclosed within campanula 2

1′ Genital complex consisting of dorsally situated papilla not enclosed within campanula 3

2(1) Genital papilla directed posteroventrally and enclosed within posteroventrally directed campanula ..... *waltonae*

2′ Genital papilla directed ventrally, enclosed within ventrally directed campanula ..... *popi* new species

3(1′) Genital complex consisting of genital papilla and two alate processes ..... *aetodes* new species

3′ Genital complex consisting of genital papilla and lacking alate processes 4

4(3′) Genital papilla directed anteroventrally and possessing saclike extension posterodorsally ..... *rhea* new species

4′ Genital papilla directed posteroventrally and lacking posterodorsal extension ..... *gypodes*

Ornithocythere aetodes new species
(Fig. 1a–e)

Male: Eyes pigmented, located approximately one-fourth shell length from anterior margin. Shell (Fig. 1b) subovate, highest posterior to midlength; margins entire; submarginal setae scarce, absent dorsally, present anteriorly, posteriorly, and ventrally. Range of shell size recorded in Table 1.

Copulatory complex (Fig. 1a, d) with peniferum extending ventrally beyond clasping apparatus, its ventral portion highly sclerotized, beaklike prominence directed anterodorsally with swelling on proximoventral angle; penis large, U-shaped, situated in distal one-fifth of peniferum,

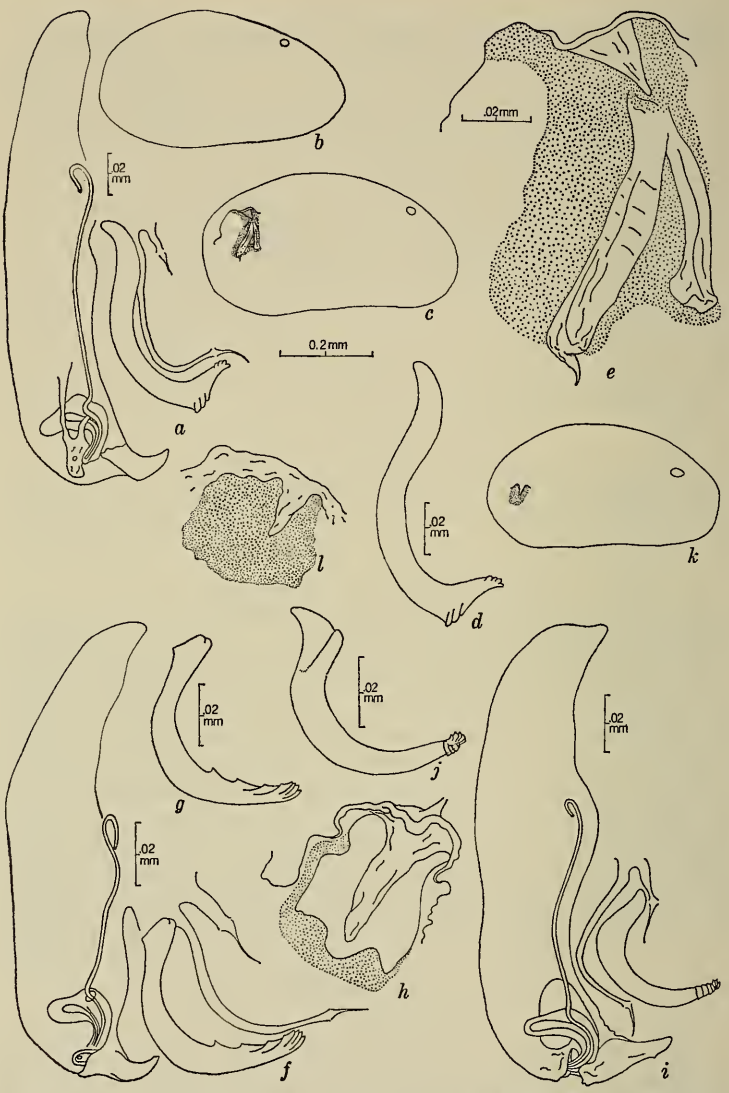

FIG. 1a–e. *Ornithocythere aetodes* new species; Fig. 1f–g. *Ornithocythere waltonae* Hobbs, 1967; Fig. 1i–l. *Ornithocythere gypodes* Hobbs III, 1969. Fig. 1a, f, i. Mesial views of entire male copulatory complexes; Fig. 1b. Lateral view of right valve of male; Fig. 1c, k. Lateral views of right valve of females (b, c, k, to scale indicated below c); Fig. 1d, g, j. Clasping apparatus of males; Fig. 1e, h, l. Female genitalia (to scale indicated by e).

and supported by sclerotized penis guide, latter extending dorsally beyond level of penis. Clasping apparatus S-shaped, not clearly divisible into horizontal and vertical rami; external and internal borders entire except external border bearing three smooth prominences at distal one-fifth and distalmost portion terminating in four apical denticles; ventral finger four times length of dorsal finger—former slender, L-shaped, paralleling clasping apparatus, latter slender and directed ventrally.

Triunguis female: Eyes pigmented; shell (Fig. 1c) subovate with concavity slightly anterior to midlength; margins entire; submarginal setae like those of male; genital complex consisting of sclerified conical, acute papilla (Fig. 1e) directed anteroventrally, bordered by two alate processes, anteriormost directed ventrally, posterior ala directed posteroventrally and terminating distally in recurved spine; both papilla and alae enclosed in amorphous mass. Range of shell size recorded in Table 1.

Type-locality: Burrow from ditch along St. Rte. 28, 0.5 mi. W. of jct. St. Rtes. 28 and 35, Smith County, Mississippi (Leaf River drainage). This species has been collected from no other locality.

Disposition of types: The holotypic male, allotype and male paratype are deposited in the National Museum of Natural History (Smithsonian Institution), nos. 126264 and 126265, respectively. Paratypes are in the collections of C. W. Hart, Jr. (1 ♂), the Smithsonian Institution (1 ♂), and the author (1 ♂).

Host: Cambarus d. diogenes Girard.

Entocytherid associate: Ankylocythere harmani Hobbs, 1966:71.

Relationships: Ornithocythere aetodes has its closest affinities with *O. waltonae* (Fig. 1f–h). The penifera of both are quite similar in shape and structure, particularly in the ventral portion. *O. aetodes*, however, possesses an S-shaped clasping apparatus, the external border of which bears three smooth prominences, whereas *O. waltonae* supports a C-shaped clasping apparatus in which the external border is entire. *O. gypodes* and *O. popi* are similar in that they share with *O. aetodes* the "bird-head" peniferum. *O. aetodes* demonstrates the close relationship that exists between the genera *Ornithocythere* and *Geocythere*.

The structure of the male copulatory complex of *O. aetodes* provides some insight into a probable common origin of the genera *Geocythere*, *Hartocythere* (see below), *Okriocythere*, and *Ornithocythere*. Like the members of the genus *Geocythere*, *O. aetodes* possesses excrescences on the external border of the clasping apparatus as does the monotypic *Okriocythere* Hart, 1964: 243; also, the length of the peniferum from the dorsalmost level of the clasping apparatus to its ventral extremity approaches that of the members of the genus *Geocythere*. Its affinities to *Hartocythere* are most obviously indicated in the alate process of the female genital complex (c.f. Figs. 1e and 2n).

Etymology: Aëtos (Greek) = eagle + oides = like—referring to the

TABLE 1. Measurements (in millimeters).

	holotype	males	allotype	females
Ornithocythere aetodes				
number of specimens		5		5
length (range)	0.55	0.52–0.55	0.54	0.53–0.58
mean		0.54		0.54
height (range)	0.31	0.29–0.32	0.32	0.30–0.34
mean		0.30		0.32
Ornithocythere gypodes				
number of specimens		7		7
length (range)	0.50	0.45–0.50	–	0.48–0.50
mean		0.46		0.48
height (range)	0.25	0.23–0.29	–	0.25–0.29
mean		0.26		0.27
Ornithocythere popi				
number of specimens		10		6
length (range)	0.43	0.37–0.45	0.41	0.40–0.44
mean		0.43		0.42
height (range)	0.22	0.22–0.25	0.22	0.22–0.25
mean		0.23		0.24
Ornithocythere rhea				
number of specimens		5		4
length (range)	0.46	0.46–0.50	0.48	0.48–0.49
mean		0.48		0.48
height (range)	0.25	0.25–0.28	0.29	0.29–0.30
mean		0.27		0.30
Ornithocythere waltonae				
number of specimens		10		10
length (range)	0.49	0.47–0.50	0.52	0.49–0.52
mean		0.49		0.51
height (range)	0.27	0.25–0.27	0.30	0.28–0.31
mean		0.27		0.30
Hartocythere torreya				
number of specimens		10		5
length (range)	0.48	0.43–0.48	–	0.48–0.51
mean		0.46		0.50
height (range)	0.27	0.25–0.34	–	0.26–0.28
mean		0.27		0.27

ventral portion of the peniferum of the male resembling the inverted head of an eagle.

Ornithocythere gypodes Hobbs III, 1969
(Fig. 1j, k, l)

At the time of the original description, the holotype was the only known representative of this species. Subsequently, many specimens (both male and female) have been obtained from the burrowing crayfish *Cambarus diogenes* in two additional localities in Pickens County, Alabama and from two localities in Noxubee County, Mississippi. The acquisition of these specimens permits a description of the triunguis female of the species and a more accurate account of the clasping apparatus (Fig. 1i, j) of the male.

Triunguis Female: Eyes pigmented; shell (Fig. 1k) subovate with greatest height slightly posterior to midlength; margins entire; submarginal setae present except dorsally; genital complex consisting of sclerified, conical papilla (Fig. 1l) directed posteroventrally and surrounded by amorphous mass. Range of shell size recorded in Table 1.

Male: Clasping apparatus (Fig. 1j) not divisible into horizontal and vertical rami; internal and external borders entire; except at distal portion where mesiodistal surface with linear series of four small tubercles; clasping apparatus terminating in three to five apical denticles. Range of shell size recorded in Table 1.

Ornithocythere popi new species
(Fig. 2g–k)

Male: Eyes pigmented, located approximately one-fourth shell length from anterior margin; shell (Fig. 2i) subovate with posterior region higher than anterior; greatest height slightly posterior to mid-length; margins entire; submarginal setae scarce, but occurring ventrally and along the anterior and posterior margins. Range of shell size recorded in Table 1.

Copulatory complex (Fig. 2g, h) with peniferum extending ventrally beyond clasping apparatus, ventral portion sclerified and terminating anteroventrally in beaklike prominence; penis large, U-shaped, and situated approximately in distal one-fourth of peniferum; clasping apparatus not clearly divisible into horizontal and vertical rami, but gently curved; external border of distal half with four annulations; distalmost portion terminating in three apical denticles; dorsal and ventral fingers slender, latter three times length of former; ventral finger curved parallel to clasping apparatus; both terminating in single spines.

Female: Eyes pigmented, located one-fourth shell length from anterior margin; shell (Fig. 2j) subovate with greatest height slightly posterior to midlength; margins entire; genital complex (Fig. 2k), situated posterodorsally, with sclerotized genital papilla directed ventrally, enclosed in ventrally tapering campanula with orifice at ventral extremity. Range of shell size recorded in Table 1.

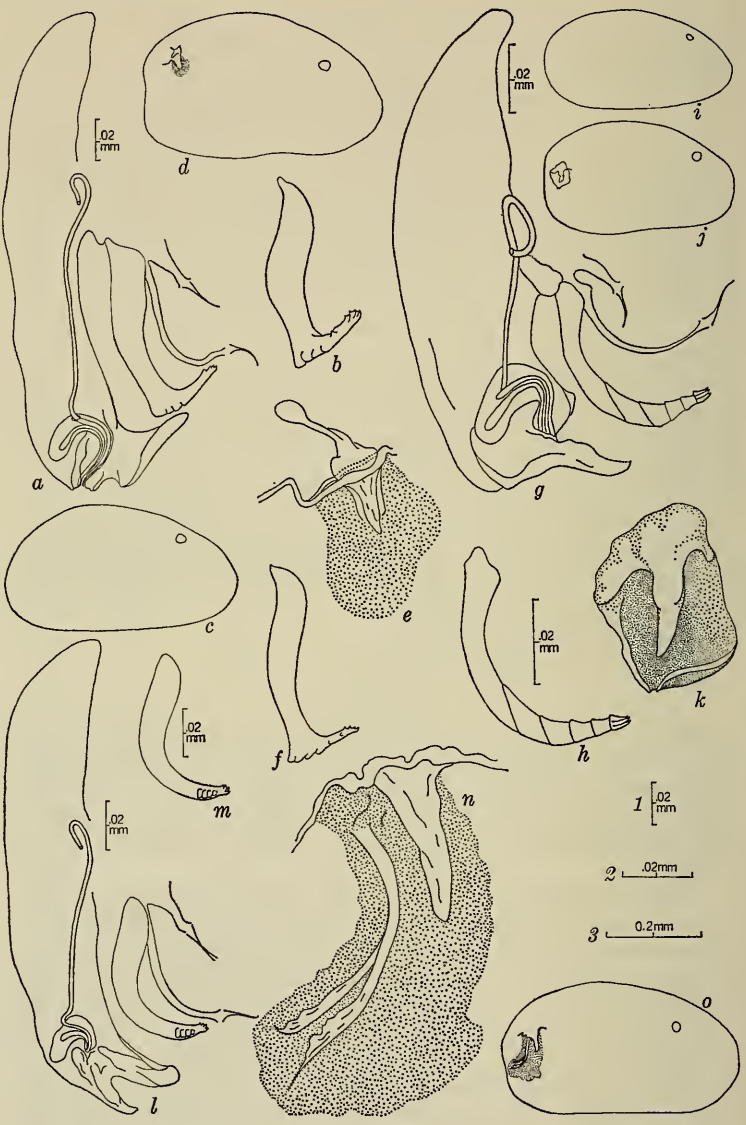

Fig. 2a–f. *Ornithocythere rhea* new species; Fig. 2g–k. *Ornithocythere popi* new species; Fig. 2l–o. *Hartocythere torreya* (Hart, 1959). Fig. 2a, g, l. Mesial views of entire male copulatory complexes; Fig. 2b, f, h, m. Clasping apparatus of males (b, f to scale 1); Fig. 2c, i. Lateral views of right valve of male (scale 3); Fig. 2d, j, o. Lateral views of right valve of female (scale 3); Fig. 2e, k, n. Female genitalia (scale 2).

Type-locality: Burrow in drainage ditch on U.S. Hwy. 49, 0.7 mi. N. of Stone-Harrison County line, Stone County, Mississippi (Biloxi River drainage).

Disposition of types: The holotypic male, allotype, and dissected male paratype are deposited in the National Museum of Natural History (Smithsonian Institution), nos. 126266 and 126267, respectively. Paratypes are in the collections of C. W. Hart, Jr. (2♂), the Smithsonian Institution (2♂), and the author (8♂, 3♀).

Hosts: Cambarus d. diogenes Girard and *C. d. ludovicianus* Faxon.

Entocytherid associates: Ankylocythere harmani Hobbs and an undescribed species of each of the genera *Ankylocythere* and *Geocythere*.

Range: In addition to the type locality, *O. popi* has been collected from burrows in the bank of a small creek on U.S. Hwy. 11, 8.8 mi. SW of jct. U.S. Hwy. 11 and St. Rte. 26, Pearl River County, Mississippi (Pearl River drainage).

Relationships: Ornithocythere popi is most closely related to *O. gypodes*. The penifera of both species resemble the head of a bird and the penes are U-shaped. The clasping apparatus are markedly similar in that both possess annulations and terminate in three apical denticles; the annulations of *O. popi* are larger and extend further proximally. This species is also closely related to *O. waltonae* and *O. aetodes* having the characteristic beaklike prominence on the anteroventral portions of the peniferum. Like *O. waltonae*, the genital complex of the triunguis female of *O. popi* is composed of a papilla which is enclosed in a campanula.

Etymology: I am pleased to name this species in honor of my father, Horton H. Hobbs, Jr., to whom I affectionately refer as "Pop."

Ornithocythere rhea new species
(Fig. 2a–f)

Male: Eyes pigmented, located approximately one-fourth shell length from anterior margin. Shell (Fig. 2c) subovate with greatest height slightly posterior to midlength; margins entire; submarginal setae evenly spaced anteriorly, ventrally, and posteriorly, but absent dorsally. Range of shell size recorded in Table 1.

Copulatory complex (Fig. 2a, b, f) with peniferum elongate, slender, and extending well beyond clasping apparatus; projection on anteroventral portion of peniferum beaklike, subacute, and extending anterodorsally; penis large, U-shaped, and extending slightly beyond ventral margin of peniferum; penis resting in groove bordered by sclerified penis guide; clasping apparatus (Figs. 2a, b, f) variable but always clearly divisible into horizontal and vertical rami; vertical ramus 2.5 times length of horizontal ramus; two rami forming angle less than 90°; external and internal borders of vertical ramus entire; mesial internal border with or without single tooth; mesial external border with row of three to five rounded prominences; apical portion with four denticles;

dorsal and ventral fingers slender each terminating in single spine; dorsal finger straight, directed anteroventrally; ventral finger gently curved anteriorly.

Triunguis female: Eyes pigmented, located approximately one-fourth shell length from anterior margin; shell (Fig. 2d) subovate with truncate posterior margin, slightly larger than male; margins entire; submarginal setae as in male; genital complex (Fig. 2e) consisting of small sclerotized papilla directed anteroventrally and surrounded by amorphous mass; sclerotized prominence with saclike extension directed posterodorsally from base of papilla. Range of shell size recorded in Table 1.

Type-locality: Trammel Creek, 1.4 mi. from jct. U.S. Hwy. 231 and 31W at Alvaton, Allen County, Kentucky (Barren River drainage). This is the only locality from which *O. rhea* has been collected.

Disposition of types: The holotypic male and allotype are deposited in the National Museum of Natural History (Smithsonian Institution), no. 126269. Paratypes are in the collections of C. W. Hart, Jr. (1♂, 1♀), the Smithsonian Institution (1♂, 1♀), and the author (2♂, 1♀).

Host: Cambarus diogenes subsp.?

Entocytherid associate: Ankylocythere hyba Hobbs and Walton, 1963.

Relationships: The male of *Ornithocythere rhea,* like all the members of the genus *Ornithocythere,* possesses a peniferum which resembles the inverted head of a bird, however it is most closely allied to *O. aetodes.* Both species possess a relatively long clasping apparatus, the mesial external borders of which bear a row of rounded prominences. The clasping apparatus of *O. rhea,* however, has an angular bend resulting in the horizontal and vertical rami being disposed at less than a right angle whereas in all other members of the genus, the clasping apparatus is never clearly divisible into two rami. *O. rhea* is also distinct in that the penis is very long and slender in comparison with the other members of the genus.

The triunguis female also shows unique characters which suggest that this species is the most remote member of the genus. Among them is the possession of a saclike extension directed posterodorsally from the base of the papilla of the genital complex (Fig. 2e).

Etymology: Rhea—a genus of ostrichlike birds—so named since the peniferum resembles the inverted head and neck of an ostrich.

Hartocythere new genus
(Fig. 2l–o)

Diagnosis: Terminal tooth of mandible pectinate. Male copulatory complex lacking finger guard and accessory groove; ventral portion of peniferum heavily sclerotized, angled anteroventrally, and deeply cleft, extending ventrally much beyond clasping apparatus; corneous penis large and curved anteroventrally, with prostatic and spermatic elements contiguous throughout their lengths. Clasping apparatus curved approximately at right angle but not distinctly divisible into vertical and

horizontal rami, mesiodistal surface bearing linear series of small tubercles and apex of apparatus with four denticles. Triunguis female without J-shaped rod or amiculum but possessing heavy, sclerotized genital papilla.

Gender: Feminine.

Type-species: Entocythere torreya Hart, 1959; here designated.

The genus *Hartocythere* is here proposed to receive a single somewhat disjunct species described by Hart, which in his generic revision (1962) he assigned to the genus *Geocythere*. With the discovery of additional species of the latter and the erection of the closely allied genus *Ornithocythere* Hobbs, 1967, of which five species are now known, uncertainty has arisen as to the limits of variation in the two genera. The removal of Hart's *G. torreya* from the genus makes *Geocythere* a more unified assemblage and permits rather concise definitions of the three genera.

Hartocythere torreya (Hart, 1959)
(Fig. 2l–o)

Entocythere torreya Hart, 1959: 198–200, figs. 7–11.

Geocythere torreya.—Hart, 1962: 135.

Male: Eyes pigmented, situated one-fourth shell length from anterior margin. Shell subelliptical with greatest height slightly posterior to midlength; margins entire. Submarginal setae few in number but evenly spaced anteriorly, posteriorly, and ventrally. Range of shell size recorded in Table 1.

Copulatory complex (Fig. 2l, m) described in diagnosis of genus.

Triunguis female: Eyes as in male. Shell (Fig. 2o) similarly shaped but slightly larger than that of male and with shallow ventral concavity slightly anterior to midlength. Submarginal setae, although sparse, evenly spaced around entire margin. Range of shell size recorded in Table 1.

Genital complex (Fig. 2n) consisting of long, slender sclerotized papilla directed slightly anteroventrally; two posteroventrally curved alate processes situated dorsal to papilla; all of these structures surrounded by amorphous mass with adhering detritus.

Type-locality: Near Blue Springs, Torreya State Park, Liberty County, Florida.

Host: Cambarus diogenes diogenes Girard.

Entocytherid associates: Three undescribed species of the genus *Ankylocythere* and *Uncinocythere simondsi* (Hobbs and Walton, 1960: 17).

Range: Hartocythere torreya has been collected in the Alabama, Escambia, Choctawhatchee, and Appalachicola drainage systems in the following: ALABAMA—Bullock, Clark, Conecuh, and Geneva counties;

FLORIDA—Escambia and Liberty counties; and GEORGIA—Randolph County.

Relationships: This species has its closest affinities with the members of the genera *Geocythere* and *Ornithocythere* but may be readily distinguished from all of them by the highly sclerotized, deeply bifid ventral portion of the peniferum.

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